NASA TECH BRIEF

Ames Research Center



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Microminiature Gas Chromatograph

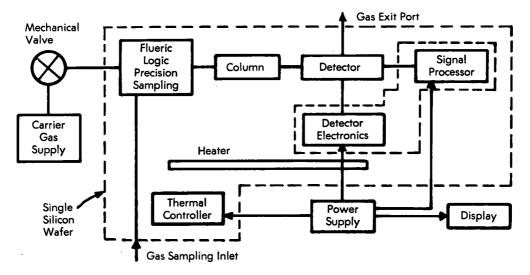
The problem:

To provide a microminiature gas chromatograph at low cost.

The solution:

Construct a complete gas chromatograph on a silicon chip with the aid of the techniques and materials commonly used for fabrication of integrated circuits.

are contained by a thin glass plate bonded to the silicon surface. The shape of the channels and their depths are controlled by the etch-resistant mask as well as by crystal lattice orientation and the type of etching solution. The capillary column is a spiral channel about 70 μ m deep and about 6.5 meters long; the inner areas may be coated with conventional liquid phases to carry out the desired chromatographic separations.



How it's done:

All components of the gas chromatograph, including sampling system, capillary column, detector, heaters, and controls are fabricated on the surfaces of a single, 2-cm square silicon wafer by the use of conventional photolithography and the etching techniques associated with the fabrication of integrated circuits. Gas flow channels are etched onto the silicon wafer and

Several types of sampling systems can be incorporated; for example, the valve body of a diaphragm valve can be etched into the silicon chip and valve action can be accomplished with a silicon diaphragm (2 mm in diameter and 5 to 10 μ m thick) bonded to the glass cover plate. This type of valve is easily controlled by differential pressure across the diaphragm, and can be incorporated with others in a manifold

(continued overleaf)

This document was prepared under the sponsorship of the National Aeronautics and Space Administration. Neither the United States Government nor any person acting on behalf of the United States Government assumes any liability resulting from the use of the information contained in this document, or warrants that such use will be free from privately owned rights.

system to provide different types of sample inlets. Another type of inlet system can be made by etching a monostable multivibrator into the silicon in conjunction with two diaphragm valves to act as flueric diodes.

Detectors, such as thermistors or pyroelectric devices, can be incorporated directly into the column by beam-leading the desired element in place. A resistive film may be deposited on the wafer in various configurations so as to supply heat at required locations. Appropriate electronic circuitry for the gas chromatograph can be of integrated-circuit construction on the same silicon wafer or, preferably, on an adjacent wafer.

The microminiature gas chromatograph is completed by the addition of a gas supply and electrical power supplies.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer Ames Research Center Moffett Field, California 94035 Reference: B72-10306

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

NASA Patent Counsel Mail Code 200-11A Ames Research Center Moffett Field, California 94035

Source: Glenn C. Carle and Ralph W. Donaldson, Jr.

Ames Research Center
with Stephen C. Terry and Kensall B. Wise of
Stanford University Associates
under contract to
Ames Research Center
(ARC-10594)